

Kolak, Shari

US EPA RECORDS CENTER REGION 5



477632

From: Tracy, Carol Hefferan (DEQ) <TracyC1@michigan.gov>
Sent: Thursday, May 08, 2014 2:35 PM
To: Kolak, Shari
Cc: Wagaw, Wally (DEQ); Franks, Robert (DEQ); Alexander, Eric (DEQ)
Subject: FW: draft 2nd FYR - West KL
Attachments: draft Second FYR for sign-off 5-7-14.docx

Shari, Wally has left for the day and asked me to reply to you directly after I finish my review.

Wally and I have both reviewed the attached Five Year Review draft for sign off and we are both pleased with the document and the revised protectiveness statement. We think you have done a terrific job! No further comments from either of us. Thank you for letting us review the draft documents.

Carol

Carol Tracy, Senior Geologist
Michigan Department of Environmental Quality
Superfund Section, Remediation and Redevelopment Division
Geology and Defense Site Management Unit
tracyc1@michigan.gov
Phone Number: 517-284-5161

From: Wagaw, Wally (DEQ)
Sent: Thursday, May 08, 2014 1:59 PM
To: Tracy, Carol Hefferan (DEQ)
Subject: FW: draft 2nd FYR - West KL

Hi Carol,

Please take a look at this Final FYRR Draft. I am out of the office tomorrow and this afternoon. I have told Shari I will get back to her with any comments we may have by Monday. Please send your comments to me, if any. Thanks.

Wally

From: Kolak, Shari [<mailto:kolak.shari@epa.gov>]
Sent: Thursday, May 08, 2014 11:53 AM
To: Wagaw, Wally (DEQ)
Subject: draft 2nd FYR - West KL

Hi Wally,

I am sending you a draft copy of the 2nd FYR report. The report has gone thru multiple layers of review already and is currently being reviewed by our attorneys. This is not the final report. I wanted to send you the draft, before its signed, so I don't repeat what happened five years ago. Once I get the attorneys comments incorporated, I will send you that version so your kept in the loop.

If you notice anything that is concerning, please let me know asap. Thanks, Shari

Shari Kolak

Remedial Project Manager
U.S. EPA, Region 5
77 W. Jackson
Chicago, IL 60604
312-886-6151 wk
kolak.shari@epa.gov

**FIVE-YEAR REVIEW REPORT FOR
WEST KL AVENUE LANDFILL SUPERFUND SITE
KALAMAZOO COUNTY, MICHIGAN**



**Prepared by:
U.S. Environmental Protection Agency
Region 5
CHICAGO, ILLINOIS**

**Richard C. Karl, Director
Superfund Division**

Date

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LIST OF ACRONYMS

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
1,4-dioxane	1,4-diethylene dioxide
DWC	Part 201 Residential Drinking Water Criteria
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
GRUZ	Groundwater Restricted Use Zone
ICs	Institutional Controls
ICIAP	Institutional Controls Implementation and Assurance Plan
KCHCSD	Kalamazoo County Health and Community Services Department
LFG	Landfill Gas
LTS	Long-Term Stewardship
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDEQ	Michigan Department of Environmental Quality
MNA	Monitored Natural Attenuation
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OUI	Operable Unit 1
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRP	Potentially Responsible Party
RI/FS	Remedial Investigation/Feasibility Study
RA	Remedial Action
RAO	Remedial Action Objectives
RD/RA	Remedial Design/Remedial Action
ROD	Record of Decision
RPM	Remedial Project Manager
Site	West KL Avenue Landfill Superfund Site
TBA	Tert-butanol
THF	Tetrahydrofuran
ug/L	Micrograms per Liter
UU/UE	Unlimited Use or Unrestricted Exposure
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY

This is the second Five-Year Review (FYR) for the West KL Avenue Landfill Superfund (Site) (a/k/a K&L Avenue Landfill) located in Oshtemo Township, Kalamazoo County, Michigan. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory FYR was the signing of the previous FYR on 5/11/2009.

The Site, formerly known as the Oshtemo Township Dump or the Kalamazoo County Landfill, is located approximately three miles west of the incorporated boundary of the City of Kalamazoo. The Site is approximately 87 acres and is surrounded by a mixture of farms, rural residential and undeveloped property. The Site operated as a small, twenty acre private dump from about 1955 until 1960 when Oshtemo Township acquired the initial parcel of property for use as a sanitary landfill. Throughout the 1960s, the Township operated the landfill as a municipal landfill. In 1968, Kalamazoo County entered into an agreement with Oshtemo Township to use the Site as a county-wide landfill. The County acquired additional acreage adjacent to the landfill to create the present 87-acre landfill Site. From approximately 1968 to 1974, the landfill accepted industrial, commercial and municipal waste. An estimated 5 million cubic yards of refuse, including some bulk liquids and drummed chemical wastes were disposed of in the landfill. The landfill was in operation until 1979 when it was closed by the Michigan Department of Environmental Quality (MDEQ) due to the detection of volatile organic compounds (VOCs) in residential drinking water supply wells downgradient of the Site.

In 2006, the Potentially Responsible Parties (PRPs) capped the landfill with a multi-layer, impermeable cover and installed a gas collection system. In 2008, the passive gas venting system was converted to an active gas collection system. Sixty-two monitoring wells are sampled annually and semi-annually to evaluate the effectiveness of the Monitored Natural Attenuation groundwater remedy. As of this second FYR, a narrow groundwater plume containing 1,4-diethylene dioxide (herein referred to as 1,4-dioxane) originates from the landfill and extends downgradient, approximately 2 miles to the northwest in the vicinity of 22nd Street (herein referred to as Van Kal Street) and West J Avenue. The most downgradient portion of the groundwater plume that exceeds the current Michigan Part 201 Residential Drinking Water Criteria (DWC) is located near 10711 W. Main Street.

This second FYR determined that a protectiveness determination for the remedy at the Site cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: 1) evaluating and implementing additional source control/contingent remedies to reduce 1,4-dioxane and THF concentrations in the groundwater; 2) continue characterizing the movement and full extent of groundwater contamination northwest of the landfill (near Van Kal Street & West J Avenue); and 3) conduct investigation for methane gas at nearby structures and if needed, take appropriate measures. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: West KL Avenue Landfill		
EPA ID: MID9800506463		
Region: 5	State: MI	City/County: Kalamazoo County, Michigan
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Shari Kolak		
Author affiliation: EPA		
Review period: 12/2/2013 - 4/30/2014		
Date of site inspection: 4/3/2014		
Type of review: Statutory		
Review number: 2		
Triggering action date: 5/11/2009		
Due date (five years after triggering action date): 5/12/2014		

Five-Year Review Summary Form (continued)

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues/Recommendations
Issues and Recommendations Identified in the Five-Year Review:

OU1	Issue Category: Institutional Controls			
	Issue: The existing ICs have not been evaluated for the landfill areas. Also, effective groundwater ICs have not been fully implemented.			
	Recommendation: PRPs will prepare an Institutional Controls Implementation and Assurance Plan (ICIAP) for review and approval for IC activities which will include information about IC implementation and long-term stewardship.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	5/29/2015

OU1	Issue Category: Remedy Performance			
	Issue: Groundwater monitoring data has not demonstrated that MNA is effective at reducing 1,4-dioxane and THF concentrations in the groundwater. The 1,4-dioxane and THF groundwater plumes also appear to be expanding and MNA is not expected to meet cleanup goals for 1,4-dioxane and THF within a reasonable timeframe.			
	Recommendation: Evaluate and implement additional source control/contingent remedies to reduce 1,4-dioxane and THF concentrations in the groundwater and to prevent further migration of plume into Van Buren County.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	1/30/2015

OU1	Issue Category: Remedy Performance			
	Issue: Full extent of groundwater contamination northwest of the landfill (near (Van Kal Street & West J Avenue) is unknown.			
	Recommendation: Continue characterizing the movement and full extent of groundwater contamination northwest of the landfill (near (Van Kal Street & West J Avenue).			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date

No	Yes	PRP	EPA/State	8/29/2014
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OU1	Issue Category: Remedy Performance			
	Issue: Existing monitoring wells P-70, P-71, P-72, and P-74 cannot serve as sentinel wells since these wells are contaminated.			
	Recommendation: Install additional sentinel wells downgradient of the groundwater plume (Van Kal Street & West J Avenue) to provide early warning for potentially vulnerable wells.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	8/29/2014

OU1	Issue Category: Institutional Controls			
	Issue: O&M Plan must be amended to include monitoring, maintaining and enforcing effective ICs.			
	Recommendation: Update O&M Plan to require inspection of ICs (deed restrictions at the landfill property and future groundwater ordinance) to ensure long-term stewardship, which includes implementing, monitoring, maintaining and enforcing effective ICs. This may be part of the ICIAP.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	2/23/2015

OU1	Issue Category: Remedy Performance			
	Issue: Methane gas may be migrating outside of the landfill perimeter.			
	Recommendation: Conduct investigation for methane gas at nearby structures and if needed, take appropriate measures.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	10/31/2014

OU1 & Sitewide Protectiveness Statement

Protectiveness Determination:
Protectiveness Deferred

Addendum Due Date
(if applicable): 5/29/2015

Protectiveness Statement:

A protectiveness determination for the remedy at the Site cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: 1) evaluating and implementing additional source control/contingent remedies to reduce 1,4-dioxane and THF concentrations in the groundwater; 2) continue characterizing the movement and full extent of groundwater contamination northwest of the landfill (near Van Kal Street & West J Avenue); and 3) conduct investigation for methane gas at nearby structures and if needed, take appropriate measures. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made.

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA 121 states:

“If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.”

EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) Section 300.430(f) (4) (ii), which states:

“If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.”

EPA conducted a FYR on the remedy implemented at the West KL Avenue Landfill Superfund Site in Kalamazoo County, Michigan. EPA is the lead agency for overseeing the PRPs on-going operation and maintenance of the remedy for the Site. Michigan Department of Environmental Quality (MDEQ), as the support agency representing the State of Michigan, has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the second FYR for the West KL Avenue Landfill Superfund Site. The triggering action for this statutory review is the completion date of the previous FYR. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The site consists of one Operable Unit, all of which is addressed in this FYR.

II. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2009 FYR

OU #	Protectiveness Determination	Protectiveness Statement
OU1	Short-term Protective	<p>The remedy at West KL currently protects human health and the environment in the short-term because the remedy prevents direct contact and exposure to contaminants in the landfill waste and groundwater, through implementation of the following actions: constructing an engineered cover over the landfill wastes that prevents direct contact with contaminants and reduces the release of contaminants into the environment; connecting over 200 homes within the proposed GRUZ to a potable water supply by providing hook-ups to city water or by constructing a new potable well in the deeper aquifer; installing a fence around the West KL property to restrict access to the landfill and its contaminants; and imposing IC deed restrictions on the landfill property prohibiting land development and groundwater use. Long-term protectiveness of this remedy relies on compliance with ICs. Compliance with ICs requires implementation of ICs and long-term stewardship of monitoring, maintaining and enforcing these landfill and groundwater ICs. This stewardship requires additional IC evaluation activities of the deed restrictions and will require amending the proposed GRUZ and implementing a countywide groundwater use ordinance to effectively prohibit potable groundwater use from two additional homes that may be potentially impacted. As proposed, the ordinance requires all homes within the GRUZ to abandon potable use of existing private drinking water wells and connect to the city water supply. The West KL remedy will protect human health and the environment in the long-term because the landfill cover will reduce the release of contaminants to the environment while preventing direct contact threats, and the groundwater remedy of MNA will attain long-term protectiveness when groundwater cleanup standards are achieved through the plume area. Although the effectiveness of MNA to achieve cleanup standards within a reasonable time-period will be evaluated in 2010, five years after the initial landfill cap construction, groundwater data collected both prior to and after the landfill cap construction show reductions in many of the groundwater contaminant concentrations. The long-term protectiveness of the remedy relies on the stewardship of implementing, monitoring, maintaining and enforcing the landfill ICs, to prevent the exposure to contaminants from the landfill.</p>

Table 2: Status of Recommendations from the 2009 FYR

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status
OU1	The GRUZ needs to be updated to include April 2009 groundwater data	Update the GRUZ to include April 2009 groundwater sampling data	PRP	EPA/State	May 2009	Completed
	Required countywide groundwater IC ordinance has not been implemented	Update the application for County ordinance to include revised GRUZ	PRP	EPA/State	May 2009	Ongoing - See discussion under Recommendation 2 below
		Agencies review and EPA endorse application for County ordinance	EPA/State	EPA	Summer 2009	
		Submit EPA approved application to Kalamazoo County	PRP	EPA	Summer 2009	
		Implement countywide groundwater IC ordinance by January 2010	PRP	EPA	January 2010	
	O&M Plan must be amended to include monitoring, maintaining and enforcing effective ICs	Update O&M Plan to require inspection of ICs (deed restrictions) at the landfill property to ensure long-term stewardship, which includes implementing, monitoring, maintaining and enforcing effective ICs	PRP	EPA/State	Summer 2009	Addressed in Next FYR See discussion under Recommendation 3 below
		Develop an IC Plan to further evaluate the deed restrictions and plan for implementation of the groundwater ordinance	EPA	EPA	October 2009	Considered but not implemented

Recommendation 2 –Implement Groundwater IC Ordinance

- This recommendation was considered but not implemented. Subsequent to the first FYR, EPA and MDEQ determined that additional groundwater investigations were necessary to fully define the extent of the groundwater plume. EPA also received a proposal for an Explanation of Significant Differences (ESD) that would revise and change the groundwater IC. These issues would need to be resolved before EPA could endorse the proposed Kalamazoo County Groundwater Restricted Use Zone (GRUZ) boundary and before the PRPs could submit the GRUZ application to Kalamazoo County for consideration of a groundwater ordinance. Per the recommendations of the 2009 FYR, the PRPs installed additional groundwater monitoring wells in 2009, 2010 and 2011 to better define the extent of the groundwater plume. EPA also has prepared a draft ESD, and if issued, would change the groundwater IC by allowing greater flexibility in the use of potable groundwater within the proposed Kalamazoo County GRUZ boundary. As of May 2014, EPA has enough information and will be endorsing the proposed Kalamazoo County GRUZ boundary.

Recommendation 3 – Update O&M Plan and Develop IC Plan

- The IC plan portion of this recommendation was considered but not implemented. This recommendation could not be implemented until the proposed ESD is signed and the proposed IC change is made. EPA will require an ICIAP from the PRPs including an updated O&M plan to require inspection of ICs.

Remedy Implementation Activities

The table below summarizes the activities implemented since the previous FYR.

Table 3: Summary of Remedy Implementation Activities Since the 2009 FYR

Date	Implemented Activities
July - August 2009	Municipal water main extended along West Main (M-43). Residences on West Main between Wickford and 1 st Street were connected to municipal water
October 6 -13, 2009	Semi-annual RA groundwater sampling
October 14 and October 22, 2009	Semi-annual residential property well monitoring
October - December 2009	Municipal water connections and residential well abandonments were conducted at residences on 1 st Street
November 3-11,2009	Monitoring wells P-67 and P-68 installed

February 15, 2010	Quarterly RA groundwater monitoring (P-67 and P-68 sampled)
April 6-16, 2010	Annual RA groundwater monitoring
April 12 -29, 2010	Annual residential property well monitoring
May 10, 2010	Residential well P-10711 converted to RA monitoring well
May 14 - May 17, 2010	Monitoring wells P-69 and P-70 installed
July 12 - 13, 2010	Quarterly RA groundwater monitoring
October 11- 15, 2010	Semi-annual RA groundwater sampling
October 13 -18, 2010	Semi-annual residential property well monitoring
January - June 2011	O&M inspection of landfill cap, perimeter gas probes, and active gas collection system
February 16, 2011	Quarterly RA groundwater monitoring
February 24 - May 2, 2011	Supplemental residential property well sampling along West J, West L, West KL and Oshtemo Trace, per Agencies request
April 7 -8, 2011	Annual RA groundwater monitoring
March 31 - April 14, 2011	Annual residential property well monitoring
July 8, 2011	Additional Hydrogeologic Investigations conducted
July 26, 2011	Quarterly RA groundwater monitoring
September 12 - October 14, 2011	Additional Hydrogeologic Investigations conducted to define the downgradient extent of groundwater plume
September 16 - October 12, 2011	Monitoring wells P-71, P-72, P-73, P-74, P-75 installed

October 10-11, 2011	Semi-annual residential property well monitoring
October 10 - October 25, 2011	Semi-annual RA groundwater sampling
August - December 2011	Municipal water connections and well abandonment provided to 26 residences along West Main (M-43), Van Kal Street, West J Avenue, Almena Drive and Wickford Drive. 17 residential property wells were abandoned.
February 1, 2012	Quarterly RA groundwater monitoring
April 9 - April 25, 2012	Annual RA groundwater monitoring
April 12, 2012	Annual residential property well monitoring
Spring 2012	Municipal water connection at 10695 W Main
July 25, 2012	Quarterly RA groundwater sampling
July 30 - October 1, 2012	Semi-annual residential property well monitoring
July 2012 - December 2012	O&M of the landfill cap including quarterly site inspection of landfill cap, perimeter gas probes, and active gas collection system
September 17 - 21, 2012	Municipal water connections provided to 2 residents on Wickford. One residential well abandoned and the other well was disconnected from home.
October 15 - October 24, 2012	Semi-annual RA groundwater monitoring
March 25- April 5, 2013	Annual RA groundwater monitoring
September 16 - September 24, 2013	Semi-annual RA groundwater monitoring
September 23 - October 24, 2013	Semi-annual residential property monitoring
October 24 - October 25, 2013	Monitoring well P-76 installed upgradient of Chaddsford Way subdivision

November 12, 2013	Monitoring well P-76 sampled
November 8 - November 22, 2013	Municipal water hook-ups provided to seven residential properties along West Main and Wickford Drive.
December 2012 - December 2013	O&M of landfill cap, perimeter gas probes, and active gas collection system

Institutional Controls

ICs are required to ensure the protectiveness of the remedy. Institutional controls (ICs) are non-engineered instruments, such as administrative and/or legal controls that help minimize the potential for exposure to contamination and protect the integrity of the remedy. Compliance with ICs is required to assure long-term protectiveness for any areas which do not allow for unlimited use or unrestricted exposure (UU/UE).

IC Requirements: One of the requirements in the 1990 ROD was the implementation of deed restrictions to prohibit future development of the landfill and prohibit potable use of groundwater wells at the landfill and at homes within the area bounded by the landfill to the east, 4th Street to the west, to the north by Almena Avenue, and to the south by West KL Avenue. See Appendix B, Figure 2 for location of the area subject to deed restrictions under the 1990 ROD. Deed restrictions were also required to restrict the shallow aquifer from being used as a drinking water source. Cleanup goals for soil were based on commercial/industrial use and cleanup goals for groundwater were based on UU/UE.

Based on new information in 2002, additional groundwater contamination was detected off-site in residential wells. In 2003, EPA issued the first ROD amendment. Relative to ICs, the First Amendment to the ROD required: implementation of institutional controls such as a county ordinance to prohibit installation of new drinking water wells within the 2003 Municipal Water Supply Area, in addition to designating a buffer zone and supplying municipal water to homes in the area among other items. In early 2004, additional groundwater contamination was detected in other areas. In 2005, EPA issued a second ROD Amendment requiring, among other things, implementation of a countywide groundwater IC ordinance on private drinking water wells within the 2005 Municipal Water Supply Area to ensure that contaminated groundwater is only used in ways that remain protective of human health. The county ordinance would prohibit the installation of new drinking water wells but would allow existing water wells to be retained if it is used solely for irrigation or other non-potable uses and if approved by Kalamazoo County and MDEQ.

Soil and Groundwater ICs

The land use ICs appear to be adequate to prevent unacceptable exposure and risk associated with the landfill. However, the ICs need to be reviewed and additional IC evaluation activities conducted to ensure that they are effective in the long-term. In 2003, an ordinance was enacted

for groundwater in the form of an amendment to the Kalamazoo County Sanitary Code. That ordinance allows groundwater restricted zones (GRUZ) to be established through an application to the County once endorsed by EPA and/or the State. The PRPs are in the process of submitting a proposed GRUZ to EPA and MDEQ for review and endorsement by EPA. Once endorsed, the proposed GRUZ will be part of the application submitted to the County. This process is expected to take six to eight months for the County to review, approve and have the ordinance ready for passage by the city council.

The table below summarizes institutional controls for these restricted areas.

Table 4: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Site Soil (OU1)	Yes	Yes	Parcels identified in Appendix B, Attachment 1	Protect integrity of landfill cap and prevent exposure to the underlying landfill waste Prohibit residential, commercial or industrial uses	Restrictive Covenant, recorded at vol 15325 (liber 1720 page 1118) at Kalamazoo County recorder's office on April 19, 1994
Site Soil (OU1)	Yes	Yes	Parcels identified in Appendix B, Attachment 1	Prevent exposure to on-site contamination by limiting land use within the landfill property area	Restrictive Covenant, recorded at vol 15325 (liber 1720 page 1118) at Kalamazoo County recorder's office on April 19, 1994
On-Site Groundwater (OU1)	Yes	Yes	Groundwater under Parcels identified in Appendix B, Attachment 1	Prohibit groundwater use until cleanup standards are achieved	Restrictive Covenant, recorded at vol 15325 (liber 1720 page 1118) at Kalamazoo County recorder's office on April 19, 1994

Off-Site Groundwater	Yes	Yes	Groundwater Restricted Use Zone shown in Appendix B, Figure 6	Prohibits drinking water well installation within areas of contaminated groundwater	Kalamazoo County Amendment to Kalamazoo County Sanitary Code, October 7, 2003
			Groundwater Restricted Use Zone shown in Appendix B, Figure 6	Prohibit groundwater use until cleanup standards are achieved	Kalamazoo County Groundwater Ordinance (Planned)

Summary of ICs Work Required

Since long-term protectiveness requires compliance with effective ICs, the current ICs should be reviewed and additional ICs need to be implemented, to ensure that effective ICs are in-place and that a plan is in place for the ICs to be maintained, monitored and enforced. To that end, the EPA is preparing a letter to the PRPs to direct them to prepare the ICIAP¹ for review and approval. An ICIAP will be requested from the PRPs consisting of specific IC evaluation activities which will incorporate the results of the IC evaluation activities and plan for any corrective measures, if needed. If sufficient ICs are not in-place or if existing ICs require changes, then new deed restrictions or covenants may be required using the model language that has been developed by the State of Michigan in conjunction with EPA. Also, title work is required to ensure that no inconsistent encumbrances might impact the remedy. The ICIAP will detail how the Group will work with the local or State government and help prevent exposure to contaminated groundwater. The ICIAP will include a schedule and plan for additional IC evaluation activities, if needed, and steps for long-term stewardship to ensure that effective ICs are maintained, monitored and enforced. The ICIAP should include updated maps which depict the areas of IC interest where UU/UE will not be established. Once prepared, the ICIAP will be submitted to EPA and the MDEQ for review and approval.

Current Compliance

According to inspections of the landfill area, there is no apparent current use of the Site which is inconsistent with the restrictions required by the ICs. However, additional work is required to review the existing ICs and to implement groundwater ICs as mentioned previously. EPA is aware that seven homeowners within the proposed Kalamazoo County GRUZ refused

¹ An ICIAP is a document designed to systematically: (a) establish and document the activities associated with implementing and ensuring the long-term stewardship of ICs and (b) specify the persons and/or organizations that will be responsible for conducting these activities. Specifically, an ICIAP focuses on identifying the details of how ICs that are selected in decision documents should be implemented, maintained, enforced, modified, and terminated (if applicable) at a specific site. See U.S. EPA's Guidance: *Institutional Controls: A Guide to Preparing Institutional Control Implementation and Assurance Plans at Contaminated Sites*; OSWER 9200.0-77, EPA-540-R-09-002, December 2012.

connections to municipal water and are currently using their private water supply wells for drinking water. The potential for exposure to contaminated groundwater will continue to occur until such time as Kalamazoo County adopts the groundwater ordinance and amends its' Sanitary Code. Based on current information, a county-wide groundwater ordinance is needed to ensure protectiveness of human health and the environment.

Long-Term Stewardship

Long-term protectiveness at the Site requires compliance with use restrictions to ensure that the remedy continues to function as intended. Compliance with effective ICs will be ensured through implementation of effective ICs and maintenance, monitoring and enforcement of effective ICs. To that end, long-term stewardship procedures will be reviewed and a plan developed as part of the ICIAP. The plan would include regular inspection of ICs at the Site and annual certification to EPA and the State that that effective ICs remain in-place. Also, development of a communications plan and use of the State's one call system shall be explored. This will be addressed in the ICIAP.

Additional IC Work Required

The following measures must be taken in order to ensure protectiveness of the remedy in the long-term. The Agencies will review and EPA endorse the proposed GRUZ so that the PRPs can submit the application to the County for the establishment of a restricted zone. Also, EPA, in conjunction with the State, will request that the PRPs prepare an ICIAP for review and approval which will include information about IC implementation and LTS.

System Operation/Operation and Maintenance Activities

O&M consist of quarterly inspections of the landfill cap cover system, landfill gas (LFG) extraction wells, perimeter gas monitoring probes, access roads, signage, security fence, storm water management system and perimeter roads. During this FYR period (2009-2014), quarterly inspections occasionally noted that small trees had fallen on perimeter fence, weeds and overburden growing on roadway, barbwire on fence needs repair, and wash out conditions due to heavy rainfall. All issues identified during the landfill inspections were fixed. In 2012, erosion repairs and surface water management enhancements were made to address erosion issues associated with perimeter roads and drainage features. Trees were also cut, perimeter fence repaired, and landfill grass mowed.

Routine monitoring of the LFG collection system is also performed. Thirty-five active LFG extraction wells are sampled monthly for methane, oxygen, carbon dioxide and nitrogen. Routine maintenance (checking flare system and operations, greasing blower, cleaning flare system, removing liquid ports on flare blowers) of the landfill gas blower/flare system is also performed monthly. Twenty-three perimeter LFG monitoring probes are also sampled quarterly. LFG monitoring probes along the western perimeter of the landfill and on the adjacent Balkema (now Oshtemo Township) property historically have high methane readings (from 2005 - May 2008) with respect to background concentrations. Methane has not been detected during this FYR period, with the exception of one sampling event. Methane was detected on July 15, 2011 in

eight perimeter gas monitoring probes above their lower explosive limit of 5%. Since then, methane has not been detected. The KLA Group attributes the elevated methane readings to a calibration issue with the GEM Gas meter. Overall, an estimated total of 3,255 pounds of VOCs have been removed by the landfill gas system. Appendix B, Attachment 2 shows the estimated mass of VOCs removed through gas collection system and flare from April 2009 through October 2013.

The average annual cost/year for O&M of the landfill cap and gas collection system is \$78,806. The average cost/year of O&M for Monitored Natural Attenuation (MNA) sampling is \$162,207. Average annual costs/year for extension of municipal water supply to residents is \$300,000.

III. FIVE-YEAR REVIEW PROCESS

Administrative Components

MDEQ was notified of the initiation of the five year review on 8/3/2013. The West KL Avenue Landfill Superfund Site Five-Year Review was led by Shari Kolak of the EPA, Remedial Project Manager for the Site. Walelign Wagaw of the MDEQ assisted in the review as the representative for the support agency.

The review, which began on 8/5/2013, consisted of the following components:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection; and
- Five-Year Review Report Development and Review.

Community Notification and Involvement

Activities to involve the community in the five-year review process were initiated with a meeting in July 2013 between the RPM and Community Involvement Coordinator for the Site. A notice was published in the local newspaper, the "Kalamazoo Gazette", on 8/5/2013, stating that there was a five-year review and inviting the public to submit any comments to the U.S. EPA. The results of the review and the report will be made available at the Site information repository located at Kalamazoo Public Library, Oshtemo Branch, 7265 W. Main Street, Kalamazoo, Michigan.

Document Review

This five-year review consisted of a review of relevant documents including O&M records and groundwater monitoring data. Applicable groundwater cleanup standards, as listed in the September 28, 1990 Record of Decision (ROD), the February 27, 2003 First ROD Amendment, and the September 12, 2005 Second ROD Amendment, were also reviewed.

Data Review

Groundwater MNA Remedy

The RA monitoring well network consists of 60 monitoring wells that are designed to monitor the performance of the MNA groundwater remedy. All 60 monitoring wells are sampled annually. Thirty-six of the 60 wells are sampled semi-annually. The RA monitoring well network consist of three groups of wells; Source Area wells (wells near or adjacent to landfill), Plume Area wells (within main plume area), and Sentinel wells (at downgradient edge of the groundwater plume). All 60 monitoring wells are sampled annually for VOCs, select natural attenuation parameters (i.e., methane, dissolved oxygen, etc.), and target parameters (1,4-dioxane, Tetrahydrofuran (THF), and Tert-butanol (TBA). All 36 wells sampled semi-annually are tested only for target parameters. A subset of the 36 wells is also tested for VOCs.

As discussed in the Technical Assessment below, the groundwater MNA remedy is effective in reducing biodegradable VOCs and cleanup goals are expected to be met within a reasonable timeframe. However, MNA is not effective in reducing concentrations of non-biodegradable VOCs, particularly 1,4-dioxane and THF. The 1,4-dioxane groundwater plume appears to be expanding and cleanup goals are not expected to be reached within a reasonable timeframe. Additional source control and/or contingent measures, in accordance with the 2005 Second ROD Amendment, need to be evaluated and implemented to reduce concentrations of 1,4-dioxane in the groundwater and prevent further expansion and continued migration of 1,4-dioxane into Van Buren County.

Table 5 – RA Monitoring Well Network

Source Area wells	Plume Area wells	Sentinel Wells
11 wells: M-8, MW-13, P-46, P-48, P-49, P-50, P-51, P-52, P-53, P-55 and TW-4	22 wells: MW-1, MW-12, P-19, P-20, P-21, P-24, P-25, P-27, P-28, P-29, P-30, P-31, P-36, P-43, P-44, P-56, P-57, P-61, P-63, P-66, P-67 and P-10711	27 wells: MW-15, P-32, P-33, P-42, P-34, P-35, P-37, P-38, P-39, P-40, P-41, P-45, P-54, P-58, P-59, P-60, P-62, P-64, P-65, P-68, P-69, P-70, P-71, P-72, P-73, P-74 and P-75

Exceedance of Groundwater Remedial Action Objectives

A total of 34 monitoring wells were sampled during the most recent (semi-annual RA sampling) groundwater sampling event in September 2013. Thirteen of 34 monitoring wells sampled during September contained VOC concentrations exceeding their respective Remedial Action Objectives (RAOs). The RAOs for groundwater are the Michigan Part 201 Residential Drinking Water Criteria (DWC).

The Part 201 DWC for the contaminants of concern at the Site are:

- 1,4-dioxane, 85 ug/L

- THF, 95 ug/L
- TBA, 3,900 ug/L
- Benzene, 5 ug/L

Eight monitoring wells in the plume area (P-36, P-44, P-56, P-57, P-61, P-63, P-66 and P-67) and five monitoring wells in the source area (P-49, P-50, P-51, P-53 and TW-4) sampled in September 2013 contained 1,4-dioxane concentrations exceeding the RAO. Concentrations of 1,4-dioxane ranged from 120 ug/L (in P-51 and P-57) to 410 ug/L (in P-53). Six monitoring wells (P-36, P-44, P-49, P-63, P-67 and TW-4) sampled in September 2013 also contained THF concentrations exceeding the RAO. Concentrations of THF ranged from 110 ug/L (in P-49) to 270 ug/L (in P-44). Twelve monitoring wells were sampled for Benzene in September 2013. Eight monitoring wells (P-46, P-48, P-49, P-50, P-51, P-52, P-53, and TW-4) sampled contained benzene concentrations exceeding the RAO. Benzene concentrations ranged from 12 ug/L (in P-46) to 270 ug/L in TW-4. No monitoring wells exceeded the RAO for TBA.

Monitoring wells with 1,4-dioxane concentrations exceeding RAOs are located within the source area and the main plume area. Monitoring wells with THF concentrations exceeding the RAO are located within the main plume area, with the exception of P-49 and TW-4, which are located within the source area. Monitoring wells with benzene concentrations exceeding the RAO are located within the source area.

Semi-annual RA groundwater sampling data collected in September 2013 can be found in Appendix B, Attachment 3.

Groundwater Trends

Groundwater trends were evaluated using sampling data collected during the annual, semi-annual, and quarterly groundwater monitoring events conducted to date. Select monitoring wells are discussed below for purposes of illustrating groundwater trends. Groundwater data, from 2009-2013, for all 60 RA monitoring wells can be found in the Annual RA (MNA) and Semi-annual RA Groundwater Monitoring Data Summary reports listed in Appendix C. The reports can also be found in the Administrative Record at the local repository identified in Section III of this FYR.

Source Area Wells

Monitoring wells P-53 and P-49 are located adjacent to the landfill. There is substantial variability in the contaminant levels observed in P-53. To illustrate this, a trend analysis was reviewed and compiled for the monitoring well P-53, which is located at the western edge of the landfill. During the April 2010 monitoring event, 1,4-dioxane was detected in P-53 at 290 ug/L. However, in April 2011, 1,4-dioxane was detected in P-53 at 1,000 ug/L. In April 2012, 1,4-dioxane was detected in P-53 at 36 ug/L and in April 2013, 1,4-dioxane was detected in P-53 at 760 ug/L. The average trend for 1,4-dioxane in P-53 shows relatively stable conditions.

There is also substantial variability in benzene, THF, and TBA concentrations observed in P-53. During the April 2010 and April 2011 monitoring events, benzene was detected in P-53 at 260

ug/L and 380 ug/L, respectively. However, in April 2012, benzene was detected in P-53 at 42 ug/L and in April 2013, benzene was detected in p-53 at 210 ug/L. The average trend for benzene in P-53 show relatively stable conditions. P-53 also showed variability in THF concentrations. During the April 2010 and April 2011 monitoring events, THF was detected in P-53 at 68 ug/L and 80 ug/L, respectively. In April 2012, THF was detected in P-49 at 26 ug/L and in April 2013, THF was detected in P-53 at 110 ug/L. The average trend for THF in P-53 shows decreasing conditions. Although TBA concentrations were variable and below the Part 201 DWC, the average trend for TBA in P-53 shows slightly decreasing or stable conditions.

The average trend for 1,4-dioxane in P-49 show slightly decreasing or stable conditions for 1,4-dioxane concentrations. During the April 2010 monitoring event, 1,4-dioxane was detected in P-49 at 450 ug/L. In April 2011, 1,4-dioxane was detected in P-49 at 300 ug/L. In April 2012, 1,4-dioxane was detected in P-49 at 260 ug/L and in April 2013, 1,4-dioxane was detected in P-49 at 270 ug/L. The average trend for benzene in P-49 show slightly decreasing or stable conditions. During the April 2010 monitoring event, benzene was detected in P-49 at 180 ug/L. In April 2011, benzene was detected in P-49 at 160 ug/L and in April 2012, benzene was detected in P-49 at 220 ug/L.

Sampling data for P-53 and P-49 from 2010-2013 is shown below. Trend charts for monitoring wells P-53 and P-49 from 2002 -2013 are in Appendix B, Attachment 4.

Table 6 –Sampling Results for Source Area Wells P-53 & P-49 (2010-2013)

P-53	units	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012	April 2013	September 2013
1,4-dioxane	ug/L	290	260	1,000	110	36	690	760	410
THF	ug/L	68	15	80	16	26	130	110	41
TBA	ug/L	500	130	390	240	190	440	410	330
Benzene	ug/L	260	89	380	NS	42	NS	210	160

Bold indicates concentrations exceed Part 201 DWC

NS – not sampled

P-49	units	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012	April 2013	September 2013
1,4-dioxane	ug/L	450	430	300	310	260	210	270	260
THF	ug/L	83	63	61	170	130	76	87	110
TBA	ug/L	620	560	510	640	570	620	530	490
Benzene	ug/L	180	240	160	180	220	NS	160	170

Bold indicates concentrations exceed Part 201 DWC
NS – not sampled

Plume Area Wells

P-66

Monitoring well P-66 is located within and near the western extent of the contaminant plume. During the April 2010 monitoring event, 1,4-dioxane was detected in P-66 at 99 ug/L. In April 2011, 1,4-dioxane was detected in P-66 at 92 ug/L. In April 2012, 1,4-dioxane was detected in P-66 at 95 ug/L and in March 2013, 1,4-dioxane was detected in P-66 at 130 ug/L. Sampling data shows an increasing trend for 1,4-dioxane in P-66. Although below the Part 201 DWC, sampling data shows an increasing trend for TBA and THF concentrations in P-66.

P-67

Monitoring well P-67 is located within and near the western extent of the contaminant plume. During the April 2010 monitoring event, 1,4-dioxane was detected in P-67 at 120 ug/L. In April 2011, 1,4-dioxane was detected in P-67 at 160 ug/L. In April 2012, 1,4-dioxane was detected in P-66 at 140 ug/L and in March, 1,4-dioxane was detected in P-67 at 190 ug/L. Sampling data shows an increasing trend for 1,4-dioxane in P-67. Sampling data also show an increasing trend for THF in P-67. Although below the Part 201 DWC, sampling data show an increasing trend in TBA concentrations in P-67.

Dissolved methane has also been detected in P-67 at consistently high levels during the past five years. Concentrations of dissolved methane were as high as 21,700 ug/L in July 2011. P-67 is located along 1st street, approximately 9,600 feet from the edge of the landfill. Due to the high concentrations of dissolved methane in groundwater in P-67 (and in monitoring wells P-10711 and P-63 which is located on Skyview Drive), the vapor intrusion pathway will be investigated as part of the recommendations in this FYR to ensure that methane gas is not present in indoor air of nearby residences at concentrations that could potentially become a fire/explosion hazard.

826 Wickford

The residential well at 826 Wickford is located near the downgradient extent of the plume. During the April 2009 monitoring event, 1,4-dioxane was detected at 15 ug/L. In April 2010, 1,4-dioxane was detected at 18 ug/L and in April 2011, 1,4-dioxane was detected at 49 ug/L. Although below Part 201 DWC, sampling data shows an increasing trend for 1,4-dioxane at 826 Wickford. Sampling data also shows an increasing trend for THF and TBA at 826 Wickford, although concentrations were below the Part 201 DWC. This residential property was connected to municipal water in September 2011.

Sampling data for P-66 and P-67 from 2010-2013 is shown in Table 7. Sampling data from 826 Wickford (2009-2011) is shown in Table 8. Trend charts for monitoring wells P-66 (2006-2013) and P-67 (2009-2013) are in Appendix B, Attachment 5. A trend chart for 826 Wickford (2002-2011) is in Appendix B, Attachment 6.

Table7 – Sampling Results for Plume Area Wells P-66 & P-67 (2010 -2013)

P-66	units	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012	March 2013	September 2013
1,4-dioxane	ug//L	99	88	92	110	95	93	130	140
tetrahydrofuran	ug//L	41	52	52	54	120	68	78	88
Tert-butanol	ug//L	310	250	340	360	370	580	470	430

Bold indicates concentrations exceed Part 201 DWC

P-67	units	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012	March 2013	September 2013
1,4-dioxane	ug//L	120	130	160	150	140	120	190	170
tetrahydrofuran	ug//L	80	97	120	100	160	110	150	160
Tert-butanol	ug//L	330	340	430	450	440	420	570	530

P-67	units	July 2010	February 2011	April 2011	July 2011	October 2011	April 2012	October 2012	March 2013
Dissolved methane	ug//L	10600	14200	15800	21700	11700	16700	10000	18000

Bold indicates concentrations exceed Part 201 DWC

Table 8 – Sampling Results for 826 Wickford (2009-2011)

826 Wickford	units	April 2009	August 2009	October 2009	April 2010	October 2010	April 2011
1,4-dioxane	ug//L	15	8	8	18	18	49
tetrahydrofuran	ug//L	5	ND	ND	5	ND	10
Tert-butanol	ug//L	70	40	40	80	160	290

Bold indicates concentrations exceed Part 201 DWC

ND – Non-detect

Sentinel Wells

Not all sentinel monitoring wells at the leading edges of the plume have sufficient data to determine trends in concentrations since the wells were installed fairly recently. However, it appears that contaminant concentrations at the furthest downgradient/leading edge of the plume (Van Kal Street North of West Main) continue to increase (but still remain below Part 201 DWC

of 85 ug/L). The two most downgradient monitoring wells, P-70 and P-71, had 1,4-dioxane levels of 11 ug/L and 16 ug/L, respectively in October 2011. In October 2012, P-70 and P-71 had 1,4-dioxane levels of 14 ug/L and 13 ug/L, respectively. In March 2013, P-70 and P-71 had 1,4-dioxane levels of 21 ug/L and 20 ug/L, respectively. In September 2013, P-70 and P-71 had 1,4-dioxane levels of 24 ug/L and 22 ug/L, respectively. Overall, there appears to be a slight increasing trend of 1,4-dioxane, THF, and TBA in P-70 and P-71 since 2011.

Sampling data for P-70 (2010-2013) and P-71 (2011-2013) are shown below. Although there is not enough data to establish a groundwater trend line, trend charts for P-70 and P-71 are in Appendix B, Attachment 7.

Table 9 –Sampling Results for Sentinel Wells P-70 & P-71 (2010/2011-2013)

P-70	Units	October 2010	April 2011	October 2011	April 2012	October 2012	March 2013	September 2013 *
1,4-dioxane	ug//L	8.6	11	11	13	14	21	24
tetrahydrofuran	ug//L	< 2	< 2	< 2	< 2	<2	6.7	5.4
Tert-butanol	ug//L	< 5	< 5	7.6	9.1	13	20	22

*-P-70 installed in May 2010

* Quarterly sampling occurred in September instead of October.

P-71	units	October 2011	April 2012	October 2012	March 2013	September 2013*
1,4-dioxane	ug//L	16	13	13	20	22
tetrahydrofuran	ug//L	< 2	2.4	2.7	4.1	6.7
Tert-butanol	ug//L	19	18	23		33

NS= Not sampled

*= P-71 installed in September 2011

*Quarterly sampling occurred in September instead of October.

Overall Conclusions

There does not appear to be significant decreasing concentrations of contaminants released from the landfill especially when comparing sampling data from Source Area wells. Large fluctuations in 1,4-dioxane in P-53 and/or stable conditions in P-49 indicate that contaminant mass is still leaving the landfill. There is also an increasing trend in some plume area wells, which indicate the plume is expanding. This is based on contaminant concentrations for two monitoring wells, P-66 and P-67, located within and near the western extent of the contaminant plume, and for the residential well located at 826 Wickford. Plume expansion is evident by comparing isoconcentration maps for 1,4-dioxane and THF from the Spring 2011, 2012, and 2013. See Appendix B, Figures 7, 8 and 9.

The performance standard for success of MNA is that contaminants show decreasing concentrations, not just stable ones. Increasing trends at any location as well as the stable trends indicate that MNA is not remediating the groundwater and the plume is not shrinking. Source control is a fundamental part of MNA. Without effective source control, contaminant loading to the aquifer will continue, plume expansion will continue, and MNA will not meet cleanup goals within a reasonable timeframe. Under this situation, the MNA remedy will also not meet its performance standard of returning the aquifer to a usable condition.

Residential Monitoring

Groundwater samples are collected by the KLA Group from 56 residential wells and the Kalamazoo County Health and Community Services Department (KCHCSD), under contract to the MDEQ, collects samples from 21 residential wells near the landfill. Groundwater samples by the KLA Group are tested for specific landfill related VOCs, 1,4-dioxane, and THF.

Groundwater samples collected by KCHCSD are tested for all volatile organic compounds and specific landfill related contaminants (1,4-dioxane, THF, and TBA). Sampling frequency varies (annual, semi-annual, biennially) based on groundwater flow direction and the proximity of the resident well to the groundwater plume. Wells that have an increased potential risk of contamination are sampled more frequently. All sampling results are reported to residents within one week the KLA Group and/or KCHS receipt of laboratory data. An updated (2013) Residential Monitoring List (homes sampled and frequency of sampling) is in Appendix B, Attachment 8.

While there have been low-level detections of 1,4-dioxane and THF in some residential wells, all groundwater samples, except for 10711 W. Main, were below the Michigan Part 201 DWC. Concentrations of 1,4-dioxane in the well water at 10711 W. Main approached the Part 201 DWC in 2010. The KLA Group connected 10711 Main to municipal water and converted the existing residential well into a RA monitoring well (P-10711). This well is now part of the RA monitoring well network that monitors the performance of the MNA groundwater remedy. A trend chart for P-10711 from 2008-2013 is in Appendix B, Attachment 9.

Residential Monitoring – Data Summary Reports from 2009 to 2013 can be found in the Administrative Record at the locations listed under Section III of this FYR.

Municipal Water Connections

As of this second five year review, a total of 296 residential properties have been connected to municipal water. There are also 26 residential properties that connected to municipal water but retained their private wells for irrigation and/or to operate heat pump systems. Seven homeowners refused hook-ups, despite numerous attempts by the PRPs, and are using their private wells for drinking water. The potential for exposure to contaminated groundwater will continue to occur until such time as Kalamazoo County adopts the groundwater ordinance and amends its' Sanitary Code.

Site Inspection

The inspection of the Site was conducted on 4/3/2014. In attendance were Shari Kolak, EPA; Walelign Wagaw of the MDEQ; Bill Gierke of Pfizer, representing the PRPs; and Bob Illes of Golder Associates (contractor to Pfizer). The purpose of the inspection was to assess the protectiveness of the remedy. During the inspection, monitoring wells, landfill cover, and the site security fence were inspected. A connection to a landfill gas motoring probe was observed to be loose or disconnected at the time of the inspection. The KLA Group repaired the connection following the site inspection. No other issues were noted during the site inspection. The completed five-year review checklist is included in Appendix B, Attachment 10.

Interviews

During the site inspection on 4/3/2014, an interview was conducted with a resident of Wickford Drive. The purpose of the interview was to document any perceived problems or successes with the remedy that has been implemented to date. The resident expressed concern that the MNA groundwater remedy was not working for 1,4-dioxane and THF, that the groundwater plume is expanding, and suggested that flow of 1,4-dioxane and THF be cut off from the landfill and the groundwater plume treated. The resident provided a written letter at the time of the interview. The letter is in the Administrative Record at the repositories identified under Section III of this FYR.

IV. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

No. The groundwater MNA remedy is effective in reducing biodegradable VOCs and cleanup goals are expected to be met within a reasonable timeframe. However, MNA is not effective in reducing concentrations of non-biodegradable VOCs, particularly 1,4-dioxane and THF. The 1,4-dioxane groundwater plume appears to be expanding and cleanup goals are not expected to be reached within a reasonable timeframe. Additional source control and/or contingent measures, in accordance with the 2005 Second ROD Amendment, need to be evaluated and implemented to reduce concentrations of 1,4-dioxane in the groundwater and prevent further expansion and continued migration of 1,4-dioxane into Van Buren County.

The groundwater IC, a GRUZ ordinance, is not yet in place. Although municipal water was provided to 296 impacted residences, there are seven homeowners that refused municipal water hook-ups and are currently using their private water supply wells for drinking water. The potential for exposure to contaminated groundwater will continue to occur until such time as Kalamazoo County adopts the groundwater ordinance and amends its' Sanitary Code.

The landfill cap component of the remedy is performing as expected and containment is effective at preventing exposure to landfill related contaminants. The landfill cover prevents exposure via direct contact to waste materials. The perimeter security fence and posted warning signs restrict public access to the Site thereby reducing the potential exposure to landfill waste. ICs (deed restrictions) are in place for the landfill. A Declaration of Restrictive Covenants and

Environmental Protection Easement was recorded with the Kalamazoo County Recorder of Deeds April 19, 1994. The covenant restricts groundwater use and current/future land use of landfill property. Based on inspections and monitoring results, there appears to be compliance with the land and groundwater use restrictions at the landfill. Quarterly landfill inspections indicate there is no evidence of unauthorized access by trespassers.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

There is new toxicity data for 1,4-dioxane (chronic oral assessment related exposure was revised in 2010, and inhalation and carcinogenicity assessments were revised in September 2013) which can be found at <http://www.epa.gov/iris/toxreviews/0326tr.pdf>. There have been no other changes in exposure assumptions, toxicity data, or cleanup levels for other contaminants of concern. There have been no changes to the RAOs' since the last five year review.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. Van Buren County does not have a mechanism (Sanitary Code) for implementing a county-wide groundwater ordinance. If the 1,4-dioxane groundwater plume continues to migrate, and concentrations exceed Part 201 drinking water standards, additional residential wells in Van Buren County will become impacted. Deed restrictions could be placed on individual homes however, depending on the number of homes requiring deed restrictions, it may be difficult to implement. If residents refuse the municipal water hook-ups and do not allow deed restrictions on their property, residents could be exposed to contaminated groundwater.

Also, dissolved methane was detected in several groundwater monitoring wells at concentrations that could potentially volatilize into indoor air of nearby residences and cause an explosion/fire hazard. This pathway will be investigated as a recommendation of this FYR.

Technical Assessment Summary

The landfill component of the remedy is meeting the RAOs of preventing direct contact and/or inhalation of waste materials. Access restrictions are in place. The ICs (deed restrictions) on the landfill property are in place and are preventing direct contact and exposure to landfill wastes. The majority of residential properties located within the proposed GRUZ are connected to municipal water. However, there are seven homeowners that refused municipal water hook-ups and are currently using their private water supply wells for drinking water. The potential for exposure to contaminated groundwater will continue to occur until such time as Kalamazoo County adopts the groundwater ordinance and amends its' Sanitary Code.

Existing groundwater data, both prior to and after cap construction, indicate that the MNA remedy has eliminated and/or significantly reduced some VOCs concentrations in the groundwater. However, MNA is not effective in reducing concentrations of non-biodegradable VOCs, particularly 1,4-dioxane and THF in the groundwater and cleanup goals are not expected to be reached within a reasonable timeframe. Additional source control and/or contingent

remedies need to be evaluated and implemented to reduce concentrations of 1,4-dioxane in the groundwater and prevent continued migration of 1,4-dioxane plume into Van Buren County.

V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 10 - Issues and Recommendations/Follow-up Actions

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
						Current	Future
OU1	The existing ICs have not been evaluated for the landfill areas. Also, effective groundwater ICs have not been fully implemented.	PRPs will prepare an Institutional Controls Implementation and Assurance Plan (ICIAP) for review and approval for IC activities which will include information about IC implementation and long-term stewardship.	PRP	EPA/State	5/29/2015	No	Yes
OU1	Groundwater monitoring data has not demonstrated that MNA is effective at reducing 1,4-dioxane and THF concentrations in the groundwater. The 1,4-dioxane and THF groundwater plumes also appear to be expanding and MNA is not expected to meet cleanup goals for 1,4-dioxane and THF within a reasonable timeframe.	Evaluate and implement additional source control/contingent remedies to reduce 1,4-dioxane and THF concentrations in the groundwater and to prevent further migration of plume into Van Buren County.	PRP	EPA/State	1/30/2015	No	Yes

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
						Current	Future
OU1	Full extent of groundwater contamination northwest of the landfill (near Van Kal Street & West J Avenue) is unknown.	Continue characterizing the movement and full extent of groundwater contamination northwest of the landfill (near Van Kal Street & West J Avenue).	PRP	EPA/State	8/29/2014	No	Yes
OU1	Existing monitoring wells P-70, P-71, P-72, and P-74 cannot serve as sentinel wells since these wells are contaminated.	Install additional sentinel wells downgradient of the groundwater plume (Van Kal Street & West J Avenue) to provide early warning for potentially vulnerable wells.	PRP	EPA/State	8/29/2014	No	Yes
OU1	O&M Plan must be amended to include monitoring, maintaining and enforcing effective ICs	Update O&M Plan to require inspection of ICs (deed restrictions at the landfill property and future groundwater ordinance) to ensure long-term stewardship, which includes implementing, monitoring, maintaining and enforcing effective ICs. This may be part of the ICIAP.	PRP	EPA/State	2/23/2015	No	Yes
OU1	Methane gas may be migrating outside the landfill perimeter.	Conduct investigation for methane gas at nearby structures and if needed, take appropriate measures.	PRP	EPA/State	10/31/14	No	Yes

VI. PROTECTIVENESS STATEMENT

OU1 & Sitewide Protectiveness Statement	
<i>Protectiveness Determination:</i> Protectiveness Deferred	<i>Addendum Due Date</i> <i>(if applicable): 5/29/2015</i>
<i>Protectiveness Statement:</i> A protectiveness determination for the remedy at the Site cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: 1) evaluating and implementing additional source control/contingent remedies to reduce 1,4-dioxane and THF concentrations in the groundwater; 2) continue characterizing the movement and full extent of groundwater contamination northwest of the landfill (near Van Kal Street & West J Avenue); and 3) conduct investigation for methane gas at nearby structures and if needed, take appropriate measures. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made.	

VII. NEXT REVIEW

The next five-year review report for the West KL Avenue Landfill Superfund Site is required five years from the completion date of this review.

APPENDIX A – EXISTING SITE INFORMATION

A. SITE CHRONOLOGY

Table 11 - Site Chronology

Event	Date
West KL Avenue Landfill operated as a private dump	1955 to 1960
Initial discovery of VOC contamination in residential drinking water wells	May 1979
Pre-NPL responses – Kalamazoo County placed two-foot layer of mixed soil and clay over landfill; installed a water main near the landfill just off of 4 th Street; connected 36 homes in area to municipal water, and replaced eleven contaminated private wells with deeper wells	1980
Proposed NPL listing	December 30, 1982
Final NPL listing	September 8, 1983
Superfund State Cooperative Agreement signed	June 30, 1985
EPA conducts RI/FS	February 1986 to March 1990
Final RI/FS Report Completed	May 1989 (RI Report) March 1990 (FS Report)
ROD signed	September 28, 1990
Remedial design starts (landfill)	September 18, 1992 (but later put on hold while pre-design investigations were being completed). Remedial design resumes in 2002
RD/RA Consent Decree signed	July 20, 1992 November 17, 1992 (entered in federal court)
Landfill Deed Restrictions Recorded	April 19, 1994
KLA Group provides municipal water connections to 115 residents in Spring Hills Subdivision	August 1999 to January 2000
First ROD Amendment	February 27, 2003
Remedial design complete	July 22, 2004

Municipal Water Connections and residential well abandonments along West KL, West Main, 2 nd Street and 4 th Street	August – November 2004
On-site remedial action construction start	August 23, 2004 (municipal water hook-ups under 2003 ROD Amendment)
First CD Amendment Signed	March 30, 2004 April 15, 2005 (entered in federal court)
Municipal Water Connections and well abandonments	June 2005
Second ROD Amendment Signed	September 12, 2005
RA Construction Completion -Landfill Cap Construction Completed	December 2006
Preliminary Close-Out Report signed	December 20, 2006
Final Landfill Cap Construction Inspection	April 30, 2007
Certification of Landfill Construction Completion	June 19, 2007
Second CD Amendment Signed	August 23, 2007 January 17, 2008 (entered in federal court)
Interim Remedial Action Report Signed	September 6, 2007
KLA Group extends water mains and provides municipal water to 13 homes along 1 st Street. Residential private wells abandoned and sealed	October 2, 2008 through December 5, 2008
Landfill gas flare system fully operational	May 23, 2008
First FYR	May 11, 2009
O&M	On-going

B. BACKGROUND

Physical Characteristics

The West KL Avenue Landfill Superfund Site (Site) is located in Oshtemo Township, Kalamazoo County, Michigan, approximately three miles west of the incorporated boundary of the City of Kalamazoo (See Appendix B, Figure 1). The Site is approximately 87 acres and is bordered to the south by West KL Avenue.

Land and Resource Use

The area surrounding the Site includes a mixture of farms, rural residential and undeveloped property. The closest residents to the landfill are immediately to the southeast and southwest of the landfill. Bonnie Castle Lake is located adjacent to the northeast corner of the landfill and Dustin Lake is located one mile west of the Site. Springwood Lake is located within two miles of the Site. The landfill sits above shallow and deep groundwater aquifers, separated by a thick layer of clay-rich glacial till. Both aquifers supply drinking water for Kalamazoo County. The shallow aquifer flows westerly and northwesterly toward Dustin Lake and Springwood Lake, respectively.

The landfill property is zoned industrial and since the landfill has been capped, the future use of the landfill must remain industrial. Dustin and Springwood Lakes are shallow lakes that are used for recreational purposes such as fishing, boating, and swimming.

History of Contamination

The Site operated as a small, twenty acre private dump from about 1955 until 1960 when Oshtemo Township acquired the initial parcel of property for use as a sanitary landfill. Throughout the 1960s, the Township operated the landfill as a municipal landfill. In 1968, Kalamazoo County entered into an agreement with Oshtemo Township to use the site as a county-wide landfill. The County acquired additional acreage adjacent to the landfill to create the present 87-acre landfill Site. From approximately 1968 to 1974, the landfill accepted industrial, commercial and municipal waste. An estimated 5 million cubic yards of refuse, including some bulk liquids and drummed chemical wastes were disposed of in the landfill. The landfill was in operation until 1979 when it was closed by the Michigan Department of Environmental Quality (MDEQ) due to the detection of VOCs in residential drinking water supply wells downgradient of the Site.

The Site was finalized on the NPL on September 8, 1983.

Initial Response

In 1979, the Kalamazoo County Health Department began monitoring residential wells for the MDEQ near the landfill. After the discovery of VOCs in residential wells, the MDEQ ordered the County to provide an alternate water source to affected residents and to install an impermeable cover over the landfill. In response, the County installed a new water main and provided municipal water service connections to 36 homes along West KL Avenue and South 4th Street. The County also replaced eleven private residential wells with new wells that were installed into the deeper uncontaminated aquifer. In 1980, the landfill was capped with a two foot thick layer of soil and clay. The landfill is closed and has not received any waste since May 1979.

The EPA began a remedial investigation and feasibility study (RI/FS) at the Site in February 1986 to investigate the nature and extent of contamination at the landfill and in the groundwater. The RI was completed in May 1989 and the FS in March 1990. The RI/FS found that the

groundwater contained VOCs and semi-volatile organic compounds (SVOCs). Major contaminants included vinyl chloride, chloroethane, benzene, acetone and 1, 2-dichloroethane. The RI/FS also found that a groundwater plume (area of contaminated groundwater) emanated from the landfill and extended to the west and northwest approximately 1/3 mile downgradient of the Site.

Basis for Taking Action

Hazardous substances or pollutants that have been released from the landfill (and were the primary drivers of health risks) include, but are not limited to:

Soil: Polychlorinated Biphenyls (PCBs)

Groundwater: benzene, vinyl chloride, dichloroethane, lead, cadmium, zinc

Sediment: Polycyclic aromatic hydrocarbon (PAHs)

Contaminant Exposures

A baseline human health risk assessment was performed in 1989 to evaluate health risks posed by exposure to landfill related contaminants. Actual or potential human exposure to contaminants posed by drinking the groundwater is the primary contributor to human health risks due to levels that exceed EPA's risk management criteria (i.e., excess lifetime carcinogenic risk exceeds the risk range of 1×10^{-4} to 1×10^{-6} and/or non-carcinogenic hazards exceed a hazard index (HI) quotient of 1) under reasonable exposure scenarios. At the time the risk assessment was performed, potential carcinogenic risks were high for exposures to benzene, vinyl chloride and dichloroethane in the site groundwater, as these compounds exceed Safe Drinking Water Act maximum contaminant levels (MCLs), maximum contaminant level goals (MCLGs) above zero, or other protective levels. Lead, cadmium and zinc levels are high and create a hazard index greater than 1 for site groundwater. Risks associated with all other exposure pathways were within EPA's risk range of 1×10^{-4} to 1×10^{-6} and/or non-carcinogenic hazards and do not pose a health hazard.

Actual or potential environmental receptor exposures to PCBs in surface soil of the landfill and to PAHs in sediments of Bonnie Castle and Dustin Lake were low. Concentrations of PCBs in surface soil of the landfill were at concentrations below those associated with phytotoxic effects in some species of plants. When the landfill was uncapped, PCB intake by robins and shrews ingesting PCBs that accumulated in worms in landfill soil exceeded toxicity values for these species: therefore, reproductive effects in some members of the population may have occurred. However, impacts on these species are expected to have been negligible because a small number of robins and shrews were using or inhabiting the landfill and reduced reproduction in a few members of any population will have inconsequential (in an ecological sense) effects on the reproduction of the population as a whole. PAHs in sediment of Bonnie Castle and Dustin Lake are not at concentrations sufficient to impact aquatic life.

C. REMEDIAL ACTIONS

Remedy Selection

Record of Decision

The EPA signed a ROD for the entire Site (OU1) on September 28, 1990. RAOs were developed based on the data collected during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD. The RAOs developed were to: 1) reduce and control potential risks to human health posed by exposure to contaminated groundwater and landfill waste; and 2) to restore contaminated groundwater to State cleanup standards or Federal drinking water standards, whichever is more stringent. RAOs remained the same in the 2003 and 2005 ROD Amendments discussed below.

The major components of the 1990 ROD include:

- Installation of a perimeter fence to protect the integrity of the landfill cap and restrict public access to the site;
- Construction of a multi-layer hazardous waste landfill cap to prevent exposure to the landfill waste and to reduce the amount of contamination reaching the groundwater;
- Installation of landfill gas venting system;
- Pump and treat for contaminated groundwater until Michigan Act 307-Type B groundwater cleanup standards or federal drinking water standards called MCLs and MCLGs above zero, are met (this requirement was superseded by the 2005 ROD Amendment);
- Continued long-term groundwater monitoring;
- Proper abandonment of residential drinking water wells that were replaced in the 1980s; and
- Implementation of deed restrictions to prohibit future development of the landfill and prohibit potable use of groundwater wells at the landfill and at homes within the area bounded by the landfill to the east, 4th Street to the west, to the north by Almena Avenue, and to the south by West KL Avenue. See Appendix B, Figure 2 for location of the area subject to deed restrictions under the 1990 ROD. Deed restrictions are also called for to restrict the shallow aquifer from being used as a drinking water source.

In October 1998, sampling by Kalamazoo County detected groundwater contamination in several residential drinking water wells in the Springwood Hills subdivision located approximately one-mile downgradient of the landfill. In response, the MDEQ placed several homes on bottled water temporarily. The KLA Group also voluntarily agreed to pay to extend city water main and provide municipal water service connections to all homes within the subdivision. The KLA

Group also began sampling residential wells on a routine basis to ensure that no residents were drinking contaminated groundwater. As a result of this monitoring, a number of residential wells along West KL Avenue and along 2nd Street were found to be contaminated; subsequently, these homes were connected to city water. The KLA Group also performed a limited groundwater investigation (monitoring well installation) in this area to determine the extent of this previously unknown contamination. Due to the findings of groundwater contamination in the Springwood Hills subdivision, EPA amended the ROD.

First ROD Amendment

On February 27, 2003, EPA issued the First Amendment to the ROD. The 2003 ROD Amendment required:

- Supplying municipal water to all homes within the newly created “2003 Municipal Water Supply Area” (See Appendix B, Figure 3) and abandoning private drinking water wells at each property (unless used for non-potable uses) supplied with city water to prevent exposure to contaminated groundwater;
- Implementation of institutional controls such as a county ordinance to prohibit installation of new drinking water wells within the 2003 Municipal Water Supply Area; and
- Replacement of the Michigan Act 307 Type B groundwater cleanup standards in the 1990 ROD with the current residential groundwater cleanup standards established under Part 201 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (formerly known as Michigan Act 307).

Based on the results of the pre-design studies conducted under the 1992 Consent Decree (CD), the KLA Group petitioned EPA to amend the groundwater remedy in the 1990 ROD. The proposed amended remedy would rely upon natural attenuation of the groundwater plume instead of an active pump and treat system. The KLA Group also proposed not to install the clay cap as required by the 1990 ROD, but rather to leave the existing permeable cover in place to aid in the natural degradation of contaminants in the groundwater and in the landfill wastes.

On April 17, 2002, EPA notified the KLA Group that insufficient evidence was presented to warrant amending the 1990 ROD as it relates to the requirement for an impermeable cap over the landfill waste. However, the Agency allowed the KLA Group an additional two years, not to exceed April 4, 2004, during which the Group could generate and present additional information, including alternative technology studies (e.g., sulfate addition pilot studies), they believed would support a monitoring natural attenuation (MNA) groundwater remedy.

In early 2004, the contaminant, 1,4-dioxane was found in both monitoring and residential wells above drinking water criteria. The detection of this compound at the downgradient edge of the buffer zone established in the 2003 ROD Amendment necessitated an expansion of the buffer zone at its downgradient edge to include properties an additional 1,000 feet downgradient.

The EPA subsequently amended the remedy selected by the 1990 ROD to incorporate the findings of the KLA Group's natural attenuation studies and to address additional areas of groundwater contamination beyond the area established by the 2003 ROD Amendment.

Second ROD Amendment

On September 12, 2005, EPA issued a Second Amendment to the ROD. The 2005 ROD Amendment:

- Replaced the 1990 ROD landfill cap design requirement for a two-foot thick clay layer with a geosynthetic clay layer/flexible membrane liner, and the 12-inch drainage layer with a geocomposite drainage layer. The amended cap design also reduced the two-foot thick layer of clean fill to eighteen inches, and slightly reduced the landfill slope requirements;
- Requires the supply of municipal water to all private well users (not currently supplied with city water) within an expanded area called the "2005 expanded Municipal Water Supply Area" (See Appendix B, Figure 4). This also includes the abandonment of private drinking water wells at each property supplied with city water unless used for non-potable uses;
- Requires implementation of a countywide groundwater IC ordinance on private drinking water wells within the 2005 Municipal Water Supply Area to ensure that contaminated groundwater is only used in ways that remain protective of human health. The county ordinance would prohibit the installation of new drinking water wells but would allow existing water wells to be retained if it is used solely for irrigation or other non-potable uses and if approved by Kalamazoo County and MDEQ;
- Requires a minimum one-thousand (1,000) foot distance between the downgradient boundary of the buffer zone and the location of any groundwater well with site-related contaminants above groundwater cleanup standards. By linking the width of the buffer zone to the location of site-related contaminants in groundwater, the 2005 ROD eliminates the need for future ROD amendments should the aerial extent of the groundwater plume change based on future sampling; and
- Replaced the active pump and treat groundwater remedy, selected by the 1990 ROD, with MNA and contingent remedies (i.e., sulfate addition, ozone injection, or localized groundwater extraction with above ground treatment) if MNA is ineffective in remediating the groundwater plume within a reasonable timeframe. The MDEQ did not concur with the 2005 ROD Amendment selecting MNA as the groundwater remedy.

The 2005 ROD Amendment also required that an application be made to Kalamazoo County for the establishment of a Groundwater Restricted Use Zone (GRUZ) ordinance. Upon approval by the County, the groundwater ordinance would require all private well users within the GRUZ (irrespective of whether their wells are screened in an uncontaminated or contaminated aquifer) to connect to municipal water and abandon their private drinking water supply well, subject to

limited exceptions set forth in the Kalamazoo County Sanitary Code (i.e., irrigation wells, groundwater monitoring wells, etc.) and then only if these exceptions were approved by Kalamazoo County and MDEQ.

Table 12: Groundwater Cleanup Levels

Groundwater Cleanup Levels	
Chemical	Cleanup Standard (ug/L)
Acetone	730
Barium	2,000
Benzene	5.0
2-Butanone	13,000
Cadmium	5.0
Chromium (total)	100
1,1-Dichloroethane	880
1,2-Dichloroethane	5.0
Cis-1,2-DCE	70
1,4-diethylene dioxide (1,4-dioxane)	85
Trans 1,2-DCE	100
Ethylbenzene	74
Iron	2,000
Lead	4.0
4-Methyl-2-pentanone	1,800
Nickel	100
Phenol	4,400
Tetrahydrofuran	95
1-butyl alcohol	3,900
Trichloroethene	5.0
Toluene	790
Vinyl chloride	2.0
Xylenes	280

Remedy Implementation

After issuance of the original ROD, the court entered a remedial action CD between EPA and the PRPs in November 1992. One hundred twenty eight parties were signatories to the CD. Six parties, collectively called the KLA Group, assumed primary responsibility for implementing the remedy under the CD. In accordance with the ROD and CD, the KLA Group installed a site security fence in 1992 and began the remedial design (RD) of the remedy selected in the ROD. However, the RD was put on hold later in 1993 pending further pre-RD groundwater investigations. Early in the process, the scope of these studies expanded, with approval of EPA and MDEQ, to investigate the potential for natural processes to attenuate or degrade the contaminants in the groundwater. The remedial design of the landfill cap resumed in December 2002 and the design was completed in July 2004. During this time, pre-RD groundwater investigation studies continued.

Prior to the 2003 ROD Amendment, the KLA Group voluntarily agreed to connect homes in the Springwood Hills subdivision to city water due to the discovery of groundwater contamination. Between 1999 and 2002, the KLA Group connected 123 homes to city water. After the issuance of the 2003 ROD Amendment, the court entered the first amendment to the CD in 2005, whereby the KLA Group agreed to provide city water to the remaining homes in the Springwood Hills subdivision.

Between June 2004 and December 2006, the KLA Group connected the remaining 89 homes to city water in accordance with the 2005 CD Amendment. During this time, 98 residential wells were sealed and properly abandoned. Since 1999, 212 residential properties were connected to city water and 98 private wells professionally abandoned.

After issuance of the 2005 ROD Amendment, the court entered a second amendment to the CD in 2008. Under this CD Amendment, the KLA Group agreed to finish constructing the landfill cap in accordance with the amended cap design in the 2005 ROD; to provide city water connections to additional homes; and implement MNA to treat contaminated groundwater with pump and treat as a contingent groundwater remedy. In accordance with the 2005 ROD and 2008 CD Amendment, the KLA Group completed the amended landfill cap construction. Landfill cap construction began in September 2005 and was completed in October 2006, with a final inspection occurring in April 2007. The Site reached construction completion with the signing of the Preliminary Closeout Report in December 2006. No problems were encountered during the construction. At that time, contaminants in the groundwater were expected to reach cleanup levels within approximately ten to fifteen years. Although not required by the 2008 CD Amendment, the KLA Group also converted the landfill passive gas system into an active gas collection/destruction system. Part of the active gas collection system consists of a flare to treat the collected landfill gas. Installation of the flare started in October 2007 and was completed in June 2008.

Since issuance of the 2005 ROD Amendment, the boundary of the water supply area was expanded again to include additional residential properties further downgradient based on groundwater sampling data collected in April/May 2007 and October 2007. The 2007 Municipal Water Supply Area is in Appendix B, Figure 5. Although a new water supply area was

established, a ROD Amendment was not necessary. This is because the 2005 ROD Amendment required a minimum 1,000 foot distance between the downgradient boundary of the buffer zone and the location of any groundwater well with site-related contaminants above groundwater cleanup standards. By linking the width of the buffer zone to the location of site-related contaminants in groundwater, the 2005 ROD Amendment eliminated the need for future ROD Amendments should the aerial extent of the groundwater plume.

Between October and December 2008, the KLA Group connected 14 additional homes along 1st Street to city water and abandoned 13 private wells within the 2007 Municipal Water Supply Area.

In 2009, the KLA Group extended municipal water mains along West Main (M-43), and residents on West Main between Wickford and 1st Street were connected to municipal water. In 2010, The KLA Group conducted additional hydrogeologic investigations to define the extent of the groundwater plume near Van Kal Street. Five permanent monitoring wells were installed and are monitored semi-annually or annually as part of the RA monitoring program to evaluate the effectiveness of the MNA remedy. In 2011, municipal water connections were provided to 26 residential properties along West Main Street (M-43), Van Kal Street, West J Avenue, Almena Drive and Wickford Drive. In September 2012, two additional residents on Wickford Drive were connected to municipal water. In 2013, seven residences along West Main and Wickford Drive were connected to municipal water. As of December 2013, a total of 296 residences have been connected to municipal water.

A complete list of remedy implementation activities from 2009-2013 is provided in Table 2, under Section II of this FYR.

APENDIX B – ADDITIONAL SITE INFORMATION

Figures

1. Site Location Map
2. Location of Area Subject to Deed Restrictions under 1990 ROD
3. 2003 Municipal Water Supply Area
4. 2005 Municipal Water Supply Area
5. 2007 Municipal Water Supply Area
6. 2013 Proposed Groundwater Restricted Use Zone Subject to Groundwater Ordinance
7. Spring 2011 Isoconcentration Map for 1,4-Diethylene dioxide
8. Spring 2011 Isoconcentration Map for Tetrahydrofuran
9. Spring 2012 Isoconcentration Map for 1,4-Diethylene dioxide
10. Spring 2012 Isoconcentration Map for Tetrahydrofuran
11. Spring 2013 Isoconcentration Map for 1,4-Diethylene dioxide
12. Spring 2013 Isoconcentration Map for Tetrahydrofuran

Attachments

1. Declaration of Restrictive Covenant and Environmental Protection Easement
2. Estimated Mass Removed through Gas Collection System/Flare (2009 – 2013)
3. Semi-annual Groundwater Sampling Results from September 16 -24, 2013
4. Trend Charts for Source Area Wells P-53 & P-49 (2002-2013)
5. Trend Charts for Plume Area Wells P-66 (2006-2013) and P-67 (2009-2013)
6. Trend Chart for Plume Area Well 826 Wickford (2002-2011)
7. Trend Charts for Sentinel Wells P-70 & P-71 (2011-2013)
8. 2013 Residential Monitoring List
9. Trend Chart for P-10711 (2008-2013)
10. Five-year Review Checklist

APENDIX C

DOCUMENTS REVIEWED FOR SECOND FIVE YEAR REVIEW

Decision Documents

Record of Decision dated September 28, 1990
First ROD Amendment dated February 27, 2003
Second ROD Amendment dated September 12, 2005

Residential Monitoring Program - Data Summary Report

2010 Annual Residential Monitoring Report dated August 5, 2010
2011 Annual Residential Monitoring Report dated June 17, 2011
2012 Annual Residential Monitoring Report dated June 12, 2012
2013 Annual Residential Monitoring Report - June 11, 2013

Oct. 2009 Semi-Annual Residential Monitoring Event dated January 29, 2010
Fall 2010 Semi-Annual Residential Monitoring Report dated November 29, 2010
Fall 2011 Semi-Annual Residential Monitoring Report dated December 7, 2011
Fall 2011 Updated Semi-Annual Residential Monitoring Report dated December 14, 2011
Fall 2013 Semi-Annual Residential Monitoring Report dated November 26, 2013
Updated Residential Monitoring List dated June 11, 2013

RA Activities Groundwater Sampling – Data Summary Report

Hydrogeologic Investigations

Groundwater Performance Monitoring, Initial 5 Year MNA Evaluation dated December 22, 2010.
Fall 2009 Additional Hydrogeologic Investigation and RD/RA Semi-Annual groundwater monitoring dated February 5, 2010
Fall 2011 Additional Hydrogeologic Investigations and RA Monitoring dated December 14, 2011

Annual RA Data Summary Reports

Spring 2011 Annual RA (MNA) Groundwater Monitoring DSR dated June 27, 2011
Spring 2012 Revised Annual RA (MNA) Groundwater Monitoring DSR dated July 19, 2012
Spring 2013 Annual RA (MNA) Groundwater Monitoring DSR dated June 13, 2013

Semi-Annual RA Data Summary Reports

Fall 2012 Semi-Annual RA Groundwater Monitoring, DSR dated December 4, 2012
Fall 2013 Semi-Annual RA Groundwater and Monitoring and Well Installation dated December 6, 2013
Quarterly RA Groundwater Monitoring Data Summary Report dated August 12, 2011
Quarterly RA Groundwater Monitoring Report dated March 16, 2012

RA Progress Reports

Semi-Annual Progress Report (July to December 2009) dated January 29, 2010
Annual Progress Report for 2010 dated December 14, 2010
Semi-Annual Progress Report for (July to December 2010) dated January 28, 2011
Semi-Annual Progress Report (January – June 2011) dated August 1, 2011
Semi-Annual Progress Report (July to December 2011) dated January 25, 2012
Semi-Annual Progress Report for (January to June 2012) dated July 27, 2012 (in AR under 2nd
Semi-Annual Progress Report for (July to December 2012) dated January 29, 2013
Semi-Annual Progress Reports (January 1-June 30, 2013) dated July 19, 2013
Semi-Annual Progress Report (July to December 2013) dated January 21, 2014
Annual Progress Report for 2013 dated December 16, 2013)

Municipal Water Connections

2010-2011 Municipal Water Main Extension, Water Service Connections & Well Closing dated
January 30, 2012